Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matters of	
Rulemaking to Amend Part 1 and Part 21 of the Commission's Rules to Redesignate the 27.5 - 29.5 GHz Frequency Band and to Establish Rules and Policies for Local Multipoint Distribution Service;	CC Docket No. 92-297 RM-7872; RM-7722
Applications for Waiver of the Commission's Common Carrier Point-to-Point Microwave Radio Service Rules;	
Suite 12 Group Petition for Pioneer's Preference;	PP-22
University of Texas - Pan American Petition for Reconsideration of Pioneer's Preference Request Denial	

COMMENTS OF MOTOROLA SATELLITE COMMUNICATIONS, INC.

Michael D. Kennedy
Motorola Inc.
1350 I Street, N.W.
Suite 400
Washington, D.C. 20005
(202) 371-6900

Philip L. Malet
Alfred M. Mamlet
Pantelis Michalopoulos
Steptoe & Johnson
1330 Connecticut Avenue, N.W.
Washington, D.C. 20036
(202) 429-6239

James G. Ennis
Barry Lambergman
Fletcher Heald & Hildreth
1225 Connecticut Avenue, N.W.
Suite 400
Washington, D.C. 20036
(202) 828-5782

Its Attorneys

March 16, 1993

SUMMARY

Motorola Satellite Communications, Inc. ("Motorola SatCom") hereby submits its comments to the Notice of Proposed Rulemaking and Tentative Decision released on January 8, 1993 in the above-captioned proceeding. In the Notice, the Commission proposed a new co-primary allocation of the 27.5-29.5 GHz frequency band (the "28 GHz band") to a new "Local Multipoint Distribution Service" ("LMDS") instead of the current co-primary allocation to Common Carrier Point-to-Point Microwave Radio Service. As the Commission is aware, Motorola SatCom proposes to use a segment of that band (29.1-29.3 GHz) pursuant to the existing co-primary allocation to the Fixed-Satellite Service (earth to space), for gateway/control satellite uplinks needed by Motorola SatCom's planned IRIDIUM™ system, a low-earth-orbiting system for the provision of mobile satellite service, for which Motorola SatCom has filed an application with the Commission.

Motorola SatCom submits that sharing between the IRIDIUM™ feeder uplinks and LMDS in the same band could create serious interference problems. Specifically, LMDS transmitter nodes could cause harmful interference to IRIDIUM™ satellite receivers. Moreover, IRIDIUM™ feeder uplinks could interfere with both the two-way links and video links of the LMDS system. Because of the novel characteristics of LMDS and the millimeter wave frequencies in question, it is likely that the methods for coordination and interference analysis available in the Commission's rules and the international Radio Regulations do not apply. Among other things, using information provided by an LMDS

applicant on what level of interference is acceptable to the applicant's system, Motorola SatCom has concluded that unacceptable interference to that system could result under certain conditions within line-of-sight distances between IRIDIUM™ gateway stations and LMDS nodes. Beyond line-of-site distances, it is difficult to determine whether harmful interference would result, since the existing standards do not apply and statistical information on use of the 28 GHz band for LMDS is lacking. Further, relocation of the IRIDIUM™ gateway stations beyond line-of-site distances could be economically prohibitive for Motorola SatCom.

Accordingly, Motorola SatCom submits that LMDS licensees should be precluded from operating in the 29.1-29.3 GHz band. This spectrum is essential for the feeder uplinks of the IRIDIUM™ system; one the other hand, the Commission proposes to assign ample spectrum to LMDS licensees (1 GHz to each), and therefore the set-aside of 200 MHz should not pose an undue burden on the provision of LMDS. (Motorola SatCom wishes to make clear, however, that the 200 MHz set-aside would cover the feeder link needs of the IRIDIUM™ system only: to the extent that other LEO MSS systems may require access to the 28 MHz band for feeder links, the Fixed-Satellite Service could need more than an exclusive allocation of 200 MHz in this band.)

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COMMENTS OF MOTOROLA SATELLITE COMMUNICATIONS, INC.

I. INTRODUCTION

Motorola SatCom hereby submits its comments to the Notice of Proposed Rulemaking and Tentative Decision released on January 8, 1973 in the above-captioned proceeding (the "Notice"). In the Notice, the Commission proposed a new co-primary allocation of the 27.5 - 29.5 GHz frequency band (the "28 GHz band") to a new "Local Multipoint Distribution Service" ("LMDS") instead of the current co-primary allocation to Common Carrier Point-to-Point Microwave Radio Service.[1/] The Commission also proposed rules to govern the new service.

[1/] The band is also allocated to Fixed-Satellite Service uplinks on a co-primary basis.

As the Commission explained, LMDS is a terrestrial multi-point service that uses a multi-cell configuration based on a new millimeter wave component technology engineered by Suite 12. It includes video as well as two-way interactive communications services.

In proposing the reallocation of the 28 GHz band to LMDS, the Commission argued that such reallocation would make more efficient use of "essentially fallow" spectrum. Notice at ¶ 3. The Commission pointed out that until 1991, the only licensees for the 28 GHz band under the allocation to point-to-point service were a few temporary fixed licensees. Notice at ¶ 5. The Commission noted, however, that it had received an application from Motorola SatCom to use spectrum in the 27.5 - 30.0 GHz band for gateway/control satellite uplinks in the fixed satellite service ("FSS"). Such FSS uplinks would support Motorola SatCom's proposed IRIDIUM™ system for the provision of low-earth-orbiting (LEO") mobile satellite service ("MSS").[2/] Notice at ¶ 5, n.2.

Accordingly, the Commission sought comment on "whether a separate assignment is specifically required to accommodate the proposed satellite service applications in this band or whether adequate coordination and sharing criteria would be developed to permit both terrestrial and fixed satellite services to operate compatibly in the band." Notice at ¶ 22. The Commission pointed out that whereas FSS can normally share with point-to-point

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[2/] The Commission also noted that the NASA Advanced Communication Technology Satellite, scheduled to be launched in 1993, would operate with 29 - 30 GHz uplinks.

terrestrial services, as in the 4/6 GHz band, "the multi-cell multi-point configurations [of LMDS] envision a wide area distribution of services which may foreclose the possibility of acceptable sharing conditions between satellite and terrestrial services." Id.

Motorola SatCom submits that the IRIDIUM™ system's planned FSS uplinks for gateway control functions cannot share with LMDS in the same band and that LMDS should accordingly be precluded from the 200 MHz in the 29.1 - 29.3 GHz segment of the 28 GHz band.

As Motorola SatCom has specified in its Appendix 3 FCC filing for IRIDIUM™ (which the FCC submitted to the IFRB in October 1992),[3/] the 29.1 - 29.3 GHz band is the specific segment of the 27.5-30.0 GHz band that would be used for IRIDIUM™ feeder uplinks. In its MSS Notice of Proposed Rulemaking[4/] the FCC proposed new allocations for MSS (including LEO MSS systems) but declined to propose new allocations for feeder links for LEO MSS operations beyond the existing allocations for FSS. Because other FSS bands are more densely populated with GEO FSS or with other proposed LEO FSS, use of the 28 GHz band is essential for the IRIDIUM™ feeder uplinks.

3/ Motorola SatCom has not yet filed an application for authorization of the IRIDIUM™ system's gateway and satellite control stations, as FCC staff has indicated informally that such a filing would be premature at this time.

4/ Notice of Proposed Rulemaking and Tentative Decision in the Matter of Amendment of Section 2.106 of the Commissions's Rules to Allocate the 1610 - 1626.5 MHz and the 2483.5 - 2500 MHz Bands for Use by the Mobile Satellite Service, Including Non-Geostationary Satellites, 7 FCC Rcd. 6414 (released Sept. 4, 1993).

Motorola initially plans to locate at least two gateway stations in the U.S. The sites are being chosen on account of, among other factors, their proximity to international switching centers ("ISC"s) where IRIDIUM™ would be connected with the public switched network. LMDS is also expected to be provided from nodes located in such areas. The need to satisfy the expected substantial demand for MSS will likely also require Motorola SatCom to locate IRIDIUM™ gateway stations in other metropolitan areas in the U.S., in proximity to other currently operating or future ISCS (of which there are a limited number in the U.S.).

If an IRIDIUM™ gateway station is located in the same metropolitan area as an LMDS node, sharing of frequencies could generate serious interference problems, which could not be resolved by the current technical methods prescribed by the FCC and the international Radio Regulations. Specifically, the LMDS links would interfere with the LEO MSS feeder link receivers in the IRIDIUM™ satellites. Moreover, the IRIDIUM™ FSS uplinks would interfere with both the two-way and the video LMDS links. While interference of LMDS with the IRIDIUM™ satellites might be avoided by the imposition of certain constraints on LMDS, avoidance of interference with the LMDS links would be problematic: because LMDS has novel and untested technical characteristics, and because the 28 GHz band has been very sparsely populated, little or no statistical information on use of the band by such a service is available. Therefore, the technical methods for coordination and interference analysis

prescribed by the FCC and the Radio Regulations are of questionable applicability to sharing between LMDS and FSS in that band. Among other things, the current FCC rules give no statistically developed values to the parameters necessary to conduct an interference analysis for that band. Using the information given by LMDS applicant Suite 12 on the maximum interference acceptable to its system, it follows that there would be unacceptable interference from an IRIDIUM™ gateway station with a Suite 12 node at line-of- sight ("LOS") distances (of up to 20 miles).

Beyond LOS distances, an interference analysis becomes difficult because methodologies and statistically developed values are not available. Besides, even if relocation of an IRIDIUM™ gateway station to lie outside the LOS distance from an LMDS node could avoid harmful interference, such relocation could be prohibitively expensive. It would entail the reengineering of IRIDIUM™'s gateway system and a substantial increase in the lease rental for the T-1 trunk lines needed to connect the gateway station with the International Switching Center.

Accordingly, LMDS should be precluded from operating in the 29.1 - 29.3 GHz band. While essential to Motorola SatCom, the 29.1 - 29.3 GHz band does not appear important to the LMDS applicants' ability to satisfy the expected LMDS demand. The Commission proposes to assign ample spectrum to LMDS applicants (two blocks of 1,000 MHz each, with each block assigned to one of two licensees in each Basic Trading Area). Therefore, the

ability of one of two licensees in each Basic Trading Area to provide LMDS should not be threatened by a 200 MHz set-aside.[5/]

II. MOTOROLA SATCOM'S PLANNED USE OF THE 29.1 - 29.3 GHz BAND FOR UPLINKS FROM IRIDIUM™ GATEWAY AND SATELLITE CONTROL STATIONS

Essential to the IRIDIUM™ system are its gateway and satellite control stations ("gateway stations" or "gateways"), which control access of IRIDIUM™ to, and provide interconnection with, the Public Switched Terrestrial Network ("PSTN"). As Motorola SatCom explained in its application for IRIDIUM™, filed with the FCC on December 3, 1990, each gateway station will contain up to three earth terminals, an earth terminal controller to manage communication with the constellation and the switching equipment necessary to connect to the PSTN. Application at 84. In each station, the earth terminal transmitters will operate in the 29.1 - 29.3 GHz band with narrow beam circularly polarized antennas. The transmitters will track more than one satellite at a time from a minimum of 9° above horizon through their orbital path on each pass. The Application stated that multiple stations will be distributed throughout the world, and that initially two of these stations will be sited in the continental U.S. (one in the east and one in the west), with two additional stations in eastern and western Canada to cover Canada as well as Alaska.

[5/] The 200 MHz set-aside would cover the feeder uplink needs of the IRIDIUM™ system only. Motorola SatCom cannot speak to the needs of other LEO MSS applicants. To the extent that other LEO MSS systems may require access to the 28 MHz band for feeder links, the Fixed-Satellite Service could need more than an exclusive allocation of 200 MHz in this band.

Id. An important reason for the selection of the initial two U.S. sites is the proximity of such sites to ISCs. As demand for MSS grows, Motorola SatCom expects that additional U.S. gateway stations located near an ISC would be required to satisfy it.

In its IRIDIUM™ Application, Motorola SatCom also proposed to use spectrum in the 27.5 - 30.0 and 18.8 - 20.2 GHz bands for FSS uplinks and downlinks respectively to connect the system's satellites with the IRIDIUM™ gateway stations. The uplinks are designed to function even during rainfalls that attenuate the signal by up to 26 dB. Multiple antennas separated by up to 34 nautical miles provide spatial diversity that avoids sun interference and helps mitigate rain attenuation. This ensures link availability of 99.8%. Application at 64-65.

Each of the two full-duplex gateway links is designed to support 600 simultaneous circuits for an effective capacity of 1300 voice channels (assuming the 2.2:1 DSI factor). The IRIDIUM™ Application adds that

> [t]he frequency plan requires the allocation of six distinct center frequencies each for uplink and downlink gateway links. The modulation rate in each direction is 12.5 Mbps and the channels arc spaced at 15 MHz intervals.

Application at 65.

For the purpose of accommodating this frequency design, a 200 MHz band is necessary for the gateway uplinks. This band will be uniformly segmented into 12 frequencies with a channel bandwidth of 7.5 MHz each and an occupied bandwidth of 4.38 MHz for each station's uplinks or downlinks. See the technical statement attached at Appendix 1.

III. USE OF THE 29.1 - 29.3 GHz BAND IS ESSENTIAL TO IRIDIUM™'s GATEWAY LINKS

In the MSS Notice of Proposed Rulemaking, the Commission declined to propose new allocations for feeder links for MSS LEO operations. 7 FCC Rcd. at 6418. The Commission opined that the existing FCC allocations provide sufficient capacity to serve the needs of MSS LEO feeder links.

The Commission's refusal to allocate additional spectrum to feeder links for MSS LEO systems, combined with the fact that lower FSS uplink bands are more densely populated with authorized users, makes use of the 29.1 - 29.3 GHz band essential for the IRIDIUM™ feeder uplinks. The difficulty of coordinating with existing users or prior applicants in lower bands is all the greater for IRIDIUM™, which will be required to coordinate use of spectrum for its feeder links world-wide. The Commission's conclusion that the FSS bands are sufficient for LEO feeder links would be compromised further by the proposed new co-primary allocation of the entire 28 GHz band to LMDS, a service that as demonstrated below is apt to interfere and be interfered with by a LEO system's feeder uplinks. As will be shown, a rule setting 200 MHz in the 29.1 - 29.3 GHz band aside from the ample spectrum proposed to be allocated to LMDS would preserve the essential spectrum needed by IRIDIUM™ for its feeder links without inhibiting the ability of the new service to develop.

IV. CO-EXISTENCE OF THE SUITE 12 LMDS LINKS AND THE IRIDIUM™ FEEDER UPLINKS ON THE SAME FREQUENCIES COULD CREATE SERIOUS INTERFERENCE PROBLEMS

The Suite 12 system is described in the Notice as

> a multicell configured distribution system with a return path capability. The video channels (20 MHz) are transmitted over 1 GHz of spectrum with the same polarization. Two-way communication channels are inserted between the video channels and are transmitted with opposite polarity. The system uses an omni-directional antenna to transmit from the node, or center of the cell. The subscriber's receiver antenna uses a narrow beamwidth to eliminate multipath reception and to obtain sufficient link margins for service. Each cell is designed to be between 6 to 12 miles in diameter, and shadowed areas are served with a repeater or reflector.

Notice at ¶ 9.

To accommodate the planned service, the Commission proposed to divide the 2 GHz in the 28 GHz band into two blocks of 1,000 MHz each, the A-Band from 27.5 to 28.5 GHz and the B-Band from 28.5 to 29.5 GHz. Each of the two licensees in each Basic Trading Area would be authorized to use the 1,000 MHz in one of the two bands. Within each of the two bands, video services could be provided on the one polarization (horizontal/vertical), and other (including interactive) services on the other polarization. Each of the two 1,000 MHz bands would be divided into channels of 20 MHz. Within each cell, a licensee would have flexibility to use or lease portions of one or both polarization directions and thus offer different combinations of video and other services. See Notice at ¶ 20.

The Technical Appendix prepared by Motorola SatCom and attached at Appendix 1 demonstrates that the sharing of

frequencies between the LMDS system planned by Suite 12 and the IRIDIUM™ system in the same Basic Trading Area could pose serious interference problems for both systems. Specifically, the LMDS links transmitted by the nodes' omni-directional antennas could interfere with the IRIDIUM™ feeder uplinks at the IRIDIUM™ satellite receiver. And conversely, the IRIDIUM™ feeder uplinks could interfere with both the two-way links (at the nodes' antenna receiver) and the video links (at the subscriber's receiver) of the LMDS system.

A. LMDS Transmitter Nodes Could Cause Harmful Interference to IRIDIUM™ Satellite Receivers

The Technical Appendix observes that, whenever an IRIDIUM™ station is located in the same Basic Trading Area as Suite 12 nodes, an IRIDIUM™ spot beam, which covers 2,800 square miles, would be subject to uplink interference power from 25 Suite 12 nodes at a time. Using conservative values for the link parameters (e.g., minimum antenna gain for the node antennas), the technical statement calculated that the Suite 12 network of nodes would add an unacceptable 3% of interference noise into an IRIDIUM™ LEO satellite receiver located in the same Basic Trading Area when the IRIDIUM™ feeder uplinks are transmitted to that receiver in the same frequency as Suite 12.

B. IRIDIUM™ Feeder Links Could Cause Harmful Interference to LMDS Two-Way and Video Links

1. The Methods for Coordination and Interference Analysis Prescribed in Part 25 of the Commission's Rules and Appendix 28 of the Radio Regulations are of Questionable Applicability.

Coordination and interference analysis between earth stations and terrestrial stations is normally governed by Part 25 of the Commission's rules, 47 C.F.R. § § 25.251 et seq. These rules provide formulae for calculating the maximum permissible interference power and transmission loss in a coordination analysis and deriving the coordination distance within which coordination between an earth and a terrestrial station is required. They also provide guidelines for conducting an interference analysis, including formulae for deriving the interference margin and the interference power at the receiver input of the potentially interfered-with station. The coordination analysis of Part 25 is based on the coordination analysis for two modes of propagation (tropospheric and hydrometric, not including LOS propagation) set forth in Appendix 28 to the Radio Regulation of the International Telecommunication Union ("ITU"). Both Part 25 and Appendix 28 ascribe values to the parameters needed for the formulae to be applied in coordination and interference analysis.[6/]

The formulae provided in Part 25 and Appendix 28, as well as the values ascribed to the necessary parameters, are

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[6/] But for interference analysis under Part 25, the actual transmitting power of the potentially interfering station and the actual receiving system line loss may be used if they are known instead of the table values. See 47 C.F.R. § 25.255(d).

based on statistical data derived from empirical observations of sharing between known services in certain bands. Because the 28 GHz band is sparsely populated with terrestrial and FSS users, statistical data on the sharing in that band must be equally sparse. Indeed, Table 1 of 47 C.F.R. § 25.252, which tabulates parameters to be used in the calculation of the maximum permissible interference power level and minimum permissible basic transmission loss, gives values to these parameters only for frequencies up to 14,500 MHz. Further, the tropospheric mode of propagation (one of the two modes on which the coordination analysis of Appendix 28 is based) works poorly in the 28 GHz band. Thus, in connection with an equation needed to calculate coordination distance in the tropospheric mode, a footnote to Appendix 28 counsels caution at frequencies higher than about 20 GHz, and states that studies are still being conducted. See Radio Regulations, Appendix 28-12. Even more important, LMDS is a novel service that differs in several important respects from the terrestrial service to which the band was hitherto allocated: indeed, the characteristics of the service proposed by LMDS are far removed from the modulation characteristics of wide band terrestrial links operating with 40 dB fade margins, on which the parameter values given in FCC's Table 1 are based. Therefore, statistical data on sharing with LMDS are naturally lacking for the 28 GHz band or indeed for any band.

2. On the basis of information on acceptable interference levels for the Suite 12 system given by Suite 12, the IRIDIUM™ feeder uplinks would cause harmful interference with the LMDS two-way and video links under certain conditions.

In the absence of a satisfactory coordination and interference methodology prescribed by the FCC or the Radio Regulations for the tropospheric and hydrometric modes of propagation, the technical statement conducts only a line of sight (LOS) analysis to evaluate the interference from IRIDIUM™ to Suite 12 two-way and video links, using information provided by Suite 12 on the levels of acceptable interference to its system (a minimum required carrier/noise ratio of 13 dB and rain margins without interference of 13.7 dB for two-way links and 5.5 dB for video links). If rain cells intervene between the IRIDIUM™ gateway station and satellite (in which case the power of the feeder uplink is automatically programmed to increase), the rain margin of the Suite 12 system for the two-way links approaches zero at 1.9 dB, i.e. the carrier/noise ratio is reduced to 13.7 dB, only slightly above the minimum required. For video links, the intervention of rain between the gateway station and the satellite would completely exhaust the 5.5 dB rain margin and bring it far below 0 to -7.8 (i.e., cause a degradation in the carrier/noise ratio to 5.2 dB, far below the required minimum of 13). Further, assuming that rain intervenes not only between the IRIDIUM™ gateway station and satellite but also between the LMDS subscriber and node units, the resulting degradation in the carrier/noise ratio could be even more (although statistical data that would make possible a reliable

calculation are lacking). The interference problem is made more serious because site shielding of either the gateway station or the LMDS node antennas would be impractical: among other things, the IRIDIUM™ transmitters must scan 360° in search of the IRIDIUM™ satellites; the LMDS node antennae must similarly transmit and receive to and from all directions.

3. Beyond LOS Distances (About 20 Miles), Interference Calculations are Unreliable; in Any Case, Relocation of IRIDIUM™ Stations Beyond LOS Distances Could be Economically Prohibitive.

For the reasons related above, evaluation of the interference resulting beyond LOS distances (of about 20 miles) from the tropospheric and hydrometric modes of propagation cannot be reliably undertaken on the basis of the standards prescribed in Part 25 and Appendix 28. In any case, even if interference from IRIDIUM™ beyond LOS distances could be found to be at acceptable levels, relocation of the IRIDIUM™ gateway stations to sites lying more than 20 miles away from LMDS nodes could be economically prohibitive. Such relocation would require reengineering the IRIDIUM™ gateway station to make possible the partitioning of the earth station segment from the switching equipment. Further, expensive T-1 trunk lines would need to be leased by Motorola SatCom to connect the relocated earth station to the ISC. The monthly lease rental for the requisite 16 trunk lines for a distance of about 30 miles could be considerably high. Therefore, relocation of gateway stations would avoid the interference resulting within LOS distances at an unacceptably high cost for Motorola SatCom.

V. LMDS SHOULD BE PRECLUDED FROM THE 29.1 - 29.3 GHz BAND; THAT BAND, ESSENTIAL TO THE IRIDIUM™ SYSTEM, DOES NOT APPEAR IMPORTANT TO THE ABILITY OF LMDS LICENSEES TO PROVIDE SERVICE

Because of the serious interference problems arising from the co-existence of LEO systems' feeder uplinks and LMDS in the same frequencies and Basic Trade Areas, LMDS B-Band licensees should be precluded from operating in the 29.1 - 29.3 GHz band.

While essential to Motorola SatCom, such a 200 MHz set-aside should not substantially inhibit the provision of LMDS. In each Basic Trading Area, each of two LMDS carriers would be licensed to use a block of 1,000 MHz in the A- or B-Band. Motorola's proposal for a 200 MHz exclusion from the B-Band would still leave 800 MHz in that band for use by the LMDS B-Band licensee, and should not hamper that licensee's ability to satisfy LMDS demand. Moreover, any resulting inequality between the A- and B-Bands could be reflected in the value of the two licenses, or could be balanced out by set-asides for other users from the A-Band.

VI. CONCLUSION

The Commission should amend the rules proposed to govern LMDS use of the 28 GHz band by adding at least the following rule:

The B-Band LMDS licensee shall not operate in the 29.1 - 29.3 GHz band. The 29.1 - 29.3 GHz band in all Basic

Trading Areas is accordingly excluded from the channelization instituted for the 28 GHz band for the purpose of providing LMDS.

Respectfully submitted,

Michael D. Kennedy/kel
Michael D. Kennedy
Motorola Inc.
1350 I Street, N.W.
Suite 400
Washington, D.C. 20005
(202) 371-6900

Pantelis Michalopoulos/kel
Philip L. Malet
Alfred M. Mamlet
Pantelis Michalopoulos
Steptoe & Johnson
1330 Connecticut Avenue, N.W.
Washington, D.C. 20036
(202) 429-6239

James G. Ennis
Barry Lambergman
Fletcher Heald & Hildreth
1225 Connecticut Avenue, N.W.
Suite 400
Washington, D.C. 20036
(202) 828-5782

Its Attorneys

March 16, 1993

CERTIFICATE OF SERVICE

I, Pantelis Michalopoulos, hereby certify that the foregoing Comments of Motorola Satellite Communications, Inc. were served by first-class mail, postage prepaid, this 16th day of March, 1993 on the following persons:

Andrew D. Lipman
Catherine Wang
Swidler & Berlin, Chartered
3000 K Street, N.W.
Washington, D.C. 20007
(Counsel for Motorola Microwave)

Randall L. Carl
Digital Microwave Corporation
170 Rose Orchard Way
San Jose, CA 95134

Leonard Robert Raish
George Petrutsas
Fletcher, Heald & Hildreth
Suite 400
1225 Connecticut Avenue, NW
Washington, DC 20036-2679
(Counsel for Harris Corporation - Farinon Division)

Henry M. Rivera
Melanie Haratunian
Ginsburg, Feldman and Bress Chartered
1250 Connecticut Avenue, NW
Suite 800
Washington, DC 20036
(Counsel for Suite 12 Group)

Wayne V. Black
Christine M. Gill
Rick D. Rhodes
Keller and Heckman
1150 17th Street, NW
Suite 1000
Washington, DC 20036
(Counsel for The American Petroleum Institute)

Howard Oringer
TeleSciences
600 Montgomery Street
San Francisco, CA 94111

Kathryn A. Zachem
Richard A. Hindman
Wilkinson, Barker, Knauer & Quinn
1735 New York Avenue, N.W.
Washington, D.C. 20006
(Counsel for Peninsula Engineering Group, Inc.)

Edward F. Tuck
President
Calling Communications Corp.
1900 West Garvey Avenue South
Suite 200
West Covina, CA 91790

Albert Halprin
Stephen L. Goodman
Halprin, Temple & Goodman
Suite 1020, East Tower
1301 K Street, N.W.
Washington, DC 20005
(Counsel for Video/Phone Systems, Inc.)

Paul J. Sinderbrand
Keck, Mahin & Cate
1201 New York Avenue, NW
Washington, DC 20005-3919
(Counsel for The Wireless Cable Association International, Inc.)

William T. Lundberg
Alliance Associates
P.O. Box 812263
Wellesley, MA 02181

Ronald D. Maines
Maines & Harshman, Chrtd.
Suite 900
2300 M Street, N.W.
Washington, DC 20037
(Counsel for University of Texas - Pan American)

Pantelis Michalopoulos/kl
Pantelis Michalopoulos

TECHNICAL APPENDIX

LMDS COMMENTS

1. Introduction

The Commission in Docket No. 92-297 has set forth a Notice of Proposed Rulemaking Order, Tentative Decision and Order of Reconsideration, in connection with Amendment of Part 1 and Part 21 of its Rules to Redesignate the 27.5-29.5 GHz Frequency Band and to establish Rules and Policies for Local Multipoint Distribution Service.

At paragraph 22 this Proceeding requests comment on whether a separate assignment is specifically required to accommodate the proposed satellite service applications in this band or whether adequate coordination and sharing criteria would be developed to permit both terrestrial and fixed satellite services to operate compatibly in this band.

One of the "proposed satellite services" being referenced in this request for comment is the Motorola IRIDIUM Low Earth Orbiting Satellite System. This system is proposing to use 200 MHz of this allocation, 29.1-29.3 GHz, for its uplink feederlinks. The necessary coordination requirements and sharing criteria to provide for such satellite application is the subject of discussion in the Commission's Negotiated Rule Making proceedings presently underway. This comment sets forth Motorola's view regarding the required coordination and sharing criteria which permit the IRIDIUM uplink feederlink and the proposed LMDS Service.

2.0 Motorola IRIDIUM System

The IRIDIUM system consists of sixty-six satellites in total: eleven satellites in each of six orbital planes. The orbits are circular with an altitude of 780 km and an inclination of about 86.4 degrees. The six orbital planes are displaced 31.587 degrees in longitude with respect to each other. The satellites in the even numbered planes are offset 16.347 degrees from those in the odd numbered planes. In addition, there is a 1.3 degrees plane to plane phasing of the satellites. The IRIDIUM system is capable of providing worldwide MSS services to appropriate feeder-link gateways.

Feeder-links for IRIDIUM will make use of frequencies in the Ka band (29.1-29.3 GHz uplink; 19.4-19.6 GHz downlink). This permits relatively small satellite spotbeams to be used to communicate with the feeder-link earth stations. As the satellite moves throughout its orbit, the feeder-link is maintained by tracking antennas both on the ground and on the satellites. Each IRIDIUM satellite has four independently steerable Ka-band feeder-link antennas, which will be used to maintain continuous active operation.

The IRIDIUM feeder-link spectrum requirement is 200 MHz in each of the uplink and down link band segments. Twelve 7.5 MHz channels within each band segment have been requested. These channels each have an occupied bandwidth of 4.375 MHz for each station's up/downlinks.